# The Impact of Next Generation Test Technology on Aviation Maintenance

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ABSTRACT

This paper begins by reviewing the background of avionics maintenance in DoD. It defines O, I and D levels of maintenance and details their implementation in each of the Services. OSD's ATS policy and its implementation are reviewed, as are the DoD ATS Executive Agent's goals, objectives and strategy which has five elements (management tools, DoD ATS Technical Framework, jointly develop test technologies, system-level technology demonstrations and Services implementations). The paper then details test technologies currently being developed and demonstrated by Joint Service teams. These include Multiple Low Analog Stimulus and Measurement which enable one VXI card to simultaneously provide multiple instruments; Synthetic Measurement and Stimulus Instruments; the Programmable Bus Test Instrument; ATS software technologies including multiple runtime environments, ATML, dynamic test strategies, and better use of diagnostics data; downsized electro-optics testers; and the DoD ATS Open Technical Architecture Framework which evolves as the technologies evolve. The paper discusses system level demonstrations, focusing on the ARGCS project. It then explores the impact on aviation maintenance and the many benefits of the test technologies being developed. It discusses the increased ease of reusing test software, the reduced distinction between test capability found at O, I and D levels of maintenance, the increased speed with which test capability can be fielded, the effect of an evolutionary acquisition approach on next generation testers, the blurring of boundaries between the various levels of maintenance, continued reductions in total ownership costs, and the significantly improved inter-Service interoperability of automatic testers. The paper concludes with a vision of the future centered around a robust, flexible test capability that makes possible a "purple" maintenance unit with broad capability to support Joint warfighting task forces comprised of weapon systems from all the Services.

## I MAINTENANCE CONCEPTS IN DOD

In the early 1960s, the Office of the Secretary of Defense (OSD) first defined three levels of repair: depot, intermediate, and organizational. Generally, on-system repairs and maintenance are a function of organizational level units and off-system repairs are generally performed by intermediate levels of maintenance. Intermediate-level maintenance also includes automatic and manual testing, printed circuit board repair and fabrication or manufacture of some components. Depots perform major overhaul and complete rebuilding of parts. In practice, depot and intermediate repairs for avionics systems are often equivalent since both levels of maintenance use the same or similar testers and test programs. Some in the Navy are fond of saying that for avionics systems, their intermediate level maintenance activities (Aircraft Intermediate Maintenance Departments and Marine Aviation Logistics Squadrons) perform depot level maintenance in the fleet.

Implementation of the three levels of maintenance varies by Service. Army tends to provide intermediate level support in the field. Naval and Marine Corps aviation units are supported in the field by intermediate maintenance activities on large and small aircraft carriers and at Naval Air Stations, and by the Marine Aviation Logistics Support units ashore. Navy ships and submarines have little intermediate level maintenance. USMC ground units have intermediate level support near the front lines. The Air Force shifted to a 2-level maintenance policy in the early 1990s, but there now appears a trend back to more traditional intermediate level support for deployed units. And with newer platforms there is a movement to improved embedded diagnostics and "O" to OEM strategies.

Implementation of ATS policy varies by Service as well. Since 1990, Navy (including Marine aviation) has had a policy to standardize on the Consolidated Automated Support System (CASS) for all electronic testing needs. Since 1998, USMC ground units have used the Third Echelon Test Set (TETS) as their standard tester. Army has used the Integrated Family of

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Test Equipment (IFTE) as its standard intermediate level tester since 1996. The Air Force does not have a policy to standardize on a particular tester or family of testers. Most recent USAF tester acquisitions have been COTS test systems.

None of the Service standard testers mentioned above have been successfully used in a depot or factory environment by a weapon system program. Depots typically have many different specialized test benches which perform satisfactorily in the hands of seasoned artisans. Since replacing these older but still functional testers with Service family testers would require investment funds and would increase depot repair costs, depots have been reluctant to embrace the use of standard testers. Similarly, weapon system acquisition programs have normally not been willing to direct their contractors (Joint Strike Fighter is an exception) to use a specific tester for factory and acceptance testing due to the additional expense of facilitizing the factory environment.

## II DoD Executive Agent for Automatic Test Systems

Automatic Test Systems (ATS) are used to support Department of Defense electronics and avionics weapon systems at all levels of maintenance from the front lines to the factory. During the period from 1980 to 1992, $50B was spent on automatic test equipment and its operation and support [1].

In 1994, the DoD chartered the Navy to serve as its Automatic Test Systems Executive Agent to provide Automatic Test Systems leadership across the Services. Three overarching goals were established:

- Reduce the total cost of ownership of DoD ATS
- Provide greater flexibility to the warfighter through Joint Services interoperable ATS
- Reduce logistics footprint

The Executive Agent assigned NAVAIR PMA260 to serve as the Executive Agent Office (EAO) and discharge EA responsibilities.

In 1997 a Joint Memorandum of Agreement among the Service Acquisition Executives established procedures for ensuring that all ATS acquisitions complied with DoD's ATS policy.

The flexibility required by the warfighter in modern conflict scenarios requires that the Services attain true interoperability among Automatic Test Systems. The closed architectures of most current DoD automatic test systems prohibit interoperability. Additionally, there is little standardization of instruments, interfaces or software across DoD testers. For the last several years, the DoD ATS EAO, through the Next Generation ATS (NxTest) Integrated Product Team, has led efforts to develop test technologies and an open ATS Technical Architecture Framework which will enable testers to achieve the required interoperability.

## III DoD ATS Strategy

There are five major elements of the DoD ATS Strategy to achieve the three goals outlined above:

1. **Management Tools** such as the ATS organization structure, ATS policy, and a set of processes and procedures have been put in place to help facilitate the other elements of the strategy
2. **DoD ATS Technical Framework** to serve as the target to which all DoD ATS will evolve
3. Services jointly develop **test technologies** and leverage each other's investments in ATS-related R&D
4. Periodic "snapshot in time" **system-level demonstrations** of the technologies
5. Services execute their own **implementations** of the ATS technologies and the ATS Framework through technology insertions or acquisition of new systems

### *A. The Management Tools Element*

#### *A.1. DoD ATS Policy*

Although the cancellation and rewrite of the DoD 5000 series instructions removed the policy statement specifically related to ATS acquisition, the Defense Acquisition Guidebook (October 30, 2002) includes the following statement:

"The PM shall use DoD automatic test system (ATS) families or COTS components that meet defined ATS capabilities to meet all acquisition needs for automatic test equipment hardware and software. Critical hardware and software elements shall define ATS capabilities. The PM shall consider diagnostic, prognostic, system health management, and automatic identification technologies. The PM shall base ATS selection on a cost and benefit analysis over the complete system life cycle. Consistent with the above policy, the PM shall minimize the introduction of unique types of ATS into the DoD field, depot, and manufacturing operations."

The Services will continue to implement ATS policy as previously promulgated by OSD. Each Service has internal instructions and requirements that mandate the use of either COTS testers that comply with the ATS Technical Framework or DoD ATS Families to satisfy automatic testing requirements. Although the ATS policy will be reintroduced formally with the next iteration of the downsized DoD 5000.2-R, the cancellation of the previous DoD policy will have no practical effect as Service program managers will continue to

comply with Service policies. Using COTS or DoD ATS Families is critical to lowering ATS ownership costs.

This policy was implemented in the Services by the 1997 Joint Services Memorandum of Agreement.

Additionally, the ATS Technical Architecture Framework (discussed in paragraph II.B below) is a policy requirement of the DoD Joint Technical Architecture.

*A.2. DoD ATS Organization*

The DoD ATS EAO has put several organizational elements in place to help facilitate the DoD ATS Strategy.

*A.2.1 DoD ATS Management Board*

The DoD ATS EAO leads the Joint Service DoD Automatic Test Systems Management Board (AMB) which is comprised of the senior ATS Offices from each of the Services: Army (AMSAM-DSA TMDE), Air Force (WR-ALC/LEA), Marine Corps (MCSC-TMDE), Navy (NAVAIR PMA-260) and US SOCOM (SOAL-LM). To accomplish assigned tasks, the AMB:

- provides advice and recommendations to the Service ATS Acquisition Executives on ATS matters;
- reviews Service policy deviation requests and provides recommendations to Service Milestone Decision Authorities and the ATS EA;
- performs ATS analyses and coordinates actions requested by the ATS EA; and
- is responsible for developing and implementing processes as required to support the ATS EA.

*A.2.2 DoD ATS Integrated Process Teams*

From time to time as required, the ATS EAO, in coordination with the AMB, charters Integrated Product Teams and working groups. Presently serving under the auspices of the ATS EAO are three active Joint Service IPTs with membership from all of the Services:

The ATS Test Program Set Standardization IPT is assigned to review and improve TPS acquisition procedures. This IPT successfully developed and published Mil-Prf-32070, a performance specification to be used DoD-wide for TPS development projects.

The DoD ATS Processes IPT is responsible for coordinating among the Services to leverage ATS acquisitions; monitor acquisitions for policy compliance; develop and update the DoD ATS Master Plan and the DoD ATS Selection Process Guide; review all Service ATS acquisitions, Policy Deviation Requests and Commercial Tester Acquisition Validation Requests; and conduct a periodic ATS data call.

The Next Generation Automatic Test Systems IPT, referred to as the NxTest Team, has the goals of reducing the total acquisition and support costs of DoD ATS and improving the inter- and intra-operability of the Services' ATS functions from a technical perspective.

To accomplish this tasking, the Joint Service NxTest IPT has two objectives: First, to define the elements that contribute to the above goals, and to structure and evolve a generic architecture framework to achieve these goals (i.e., re-address and evolve cost and interoperability technical objectives and the ATS Technical Architecture Framework). The generic ATS open system architecture framework must support new test needs and permit flexible insertion of updates and new technology with minimum impact on existing ATS components. The second objective of the NxTest IPT is to define, develop, demonstrate and plan implementation of emerging test technologies into the DoD maintenance test environment. The set of technologies that this IPT works is referred to aw the "NxTest Technologies" and a system level demonstration of the NxTest Technologies is the ARGCS demonstration discussed below.

*A.3. Procedures and Tools*

The DoD ATS EAO has several tools that support the published goals and objectives.

The Service Acquisition Executives have signed a Joint Memorandum of Agreement which details the processes and procedures to be used in ATS acquisition across the Services. The Joint MOA contains the ATS Policy Deviation Request and the Commercial Tester Acquisition Validation Request forms which are used when a program manager recommends acquisition of a non-Family ATS or a COTS ATS.

The EAO has also published several guides and handbooks to aid DoD program managers. Key among these are the DoD ATS Selection Process Guide, the DoD ATS (Technical) Architecture (Framework) Guide, the DoD ATS Master Plan, and the DoD ATS Cost Benefit Analysis Model. All of these are available at http://www.acq.osd.mil/ats.

*B. The ATS Technical Architecture Framework Element*

The DoD ATS Technical Framework (Fig. 1) is a mandatory requirement for all DoD ATS acquisitions. Published in the OSD Joint Technical Architecture (JTA), Combat Support Domain, Automatic Test Systems Subdomain, its focus is on

technical specifications critical to attaining interoperability among the Services' Automatic Test Systems.

The DoD ATS Technical Architecture Framework was initially developed in 1996 as a result of several government-industry workshops that were convened to identify those elements of an ATS architecture that were critical to interoperability and lowering life cycle costs. The foundation of the Framework is a set of 24 critical interfaces to be defined by commercial standards where possible. As critical interface standards are evaluated, demonstrated and approved, they are identified in the DoD Joint Technical Architecture, Combat Support Domain, Automatic Test Systems Subdomain as "mandatory" requirements. To date, "mandatory" standards have been identified for seven critical interfaces while eight candidate standards are in work.

The ATS Technical Architecture Framework evolves as test technology evolves. A function of the NxTest Team is to continually assess the architecture framework and plan the development and demonstration of standards to satisfy ATS Architecture Framework requirements.

The EAO and the NxTest Team further the ATS Technical Architecture Framework through work with standards bodies and industry groups such as the IEEE Standards Coordinating Committee 20, the IVI Foundation, the IVI E-O Working Group, the ATML/.NET Working Group and the NDIA Automatic Test Committee.

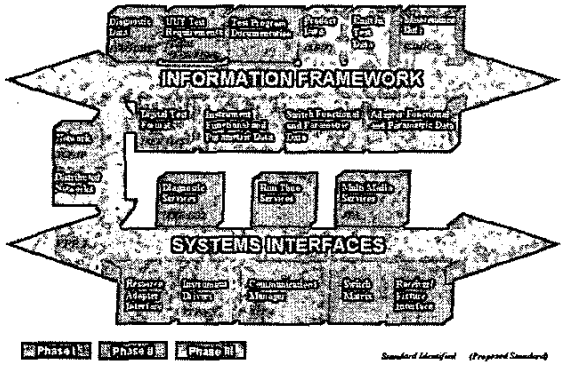


Figure 1 DoD ATS Architecture Framework

### C. *The Joint Technologies Element*

The EAO has outlined initiatives that jointly define, develop and demonstrate test technology while leveraging the Research and Development efforts of the Services, industry and coalition nation partners. The DoD ATS EAO and the Services work closely with industry through several organizations and consortia. The NxTest Team periodically holds test technology reviews with industry, and has developed close working relationships with the ATS leadership in coalition partner countries.

The ATS EAO has focused test technology development efforts toward emerging test technologies which are needed by more than one Service. Technologies needed by a specific Service to satisfy a Service-specific need will be developed by the requiring Service, although the NxTest Team will remain involved to explore any possible benefit to other Services.

Test technologies to satisfy the needs of multiple Services will be developed under the guidance of the NxTest Team which will ensure that the needs of all the Services are considered, and that the technologies are demonstrated on multiple testers.

The EAO and the NxTest Team work closely with industry to leverage investments in R&D funding and occasionally provide in-kind labor for joint industry-DoD projects. The EAO's objective is to maximize the potential utility to DoD for industry's own technology development efforts.

Emerging hardware and software technologies such as multiple simultaneous parallel analog test capability, synthetic instruments, programmable serial bus capability, inertial measurement capability, downsized electro-optics, multiple runtime environments, and dynamic test strategies offer unprecedented opportunities for improvement in warfighter support throughout DoD.

#### *C.1. Multiple Simultaneous Parallel Analog Test*

Teradyne's Ai7 Series Analog Test Instrument Subsystem (and others will emerge) is the technological breakthrough that is allowing traditionally serial ATE to perform as functional testers bringing the benefits of faster testing and higher quality diagnostics. A single C-size VXI card provides 32 channels with 6 test instruments behind each test pin. Each of these 32 independent channels can function simultaneously as one of six instruments: Function Generator, Arbitrary Waveform Generator, Digitizer, Digital Multimeter, Limit Detector, and Timer Counter. Additionally, each channel can share triggering with every other channel. This capability is being introduced into the DoD Family of Testers with the first application being several F/A-18 UUTs formerly tested on the IATS which are being rehosted to CASS. The functional test requirement would previously have been impossible to satisfy since CASS is a serial tester. However, with three Ai7 cards installed, CASS now becomes capable of parallel, functional test. There are many other potential applications for this capability within DoD.

*C.2. Synthetic Instruments*

Test and measurement requirements have been traditionally satisfied with a suite of test instrumentation that required a single test instrument for each type of test to be performed on any electrical/electronic signal. Present day commercial technology allows a signal to be converted into a digital representation that can subsequently be analyzed using high-speed digital signal processing (DSP) techniques to verify the signal's characteristics. This approach to signal characterization is known as "synthetic instrumentation." As a result, it is now possible to satisfy the signal's measurement requirements with one synthetic instrument thereby eliminating the need for numerous, dedicated, single-function measurement or stimulus instruments. As an example, six measurement functions (spectrum analysis, RF power measurement, waveform analysis, frequency/time measurement, and AC/DC voltage measurement) performed by seven discrete instruments in the Navy's CASS station are planned to be replaced by one synthetic measurement instrument. A Joint Service project now underway will develop kits for the Army's IFTE and the USMC's TETS also.

Synthetic Instruments based morphable test systems will facilitate the introduction of new test capabilities via software modification verses the introduction of peculiar new hardware and software. SI will also allow for scalable systems capable of supporting all levels of maintenance repair. Among the many benefits to DoD will be reduced logistics footprint and lower ownership costs.

*C.3. Programmable Serial Bus Test*

Current testers generally require a separate card for each bus used by a UUT. Teradyne and others have developed a Synthetic Bus Test Instrument (BTI) capable of assuming a wide range of serial bus protocols required in military and aerospace test environments. The Teradyne Bi4-Series BTI, for example, possesses built-in "morph-ability" to assume the bus protocol language of serial communications buses used in operational or factory environments. Because it is able to both emulate and test serial buses, it eliminates the need for a broad range of individual, protocol-specific test instruments.

Each BTI has four independent bus modules that support MIL-STD-1553, MIL-STD-1773, TIA/EIA-RS-232, TIA/EIA-RS-422, TIA/EIA-RS-485, H009, ARINC 429, and more. With an innovative load-and-forget programming environment, native support for popular buses, and the flexibility to emulate custom buses or variations of standard buses, each of the four bus modules provides the option to emulate a wide variety of serial bus communications and test those protocols, at any time.

The BTI will be implemented in CASS in conjunction with the Multiple Simultaneous Parallel Analog Test. Production kits became available in 2003.

Benefits to the DoD include lower ownership costs and reduced footprint.

*C.4. Software Enhanced Technologies*

Emerging software technologies based on a Windows-based operating system and a browser-based TPS developer interface using XML technologies will have many benefits, not the least of which is multiple-runtime environments resident on a single tester. Software will be multi-lingual and developed on a variety of commercial tools. The Automatic Test Markup Language (ATML), a subset of eXtensible Markup Language (XML) developed for test software development, will facilitate better use of existing diagnostics data. Standardized XML File Structures, Schemas and TAGS will be utilized as interface control standards between weapon system platforms and maintenance systems for high fidelity interoperability.

These significant software advances open the door to dynamic test strategies to make use of platform maintenance information to direct the flow of activity during TPS execution. "Directed TPSs" will reduce the time to repair by sending the test software to the most likely cause of the failure instead of performing a full end-to-end run. Test strategies can be revised on the fly based on historic and near-realtime maintenance data.

Additionally, multiple runtime and TPS development environments will facilitate direct reuse of OEM testing strategies/acceptance tests in field applications eliminating the redundant generation of performance tests (commonly referred to as Factory-to-Field). As important as the ability to rehost test software is the great reduction in the time it will take to actually develop new test software.

*D. The Joint System Level Demonstrations Element*

Periodically, the entire set of emerging technologies may be demonstrated at the system level to reduce implementation risk and to quantify the benefits of the technologies. System-level demonstrations will be designed to prove that the technologies contribute to DoD's overarching goals (reduced ownership cost, decreased logistics footprint and interoperability) and can in fact satisfy new required test capabilities.

The first Joint system level demonstration is the Agile Rapid Global Combat Support (ARGCS) System which will implement all the current technologies and architecture efforts (including some not yet demonstrated) into an integrated

support system to prove that together the technologies can provide a truly interoperable test solution that will satisfy DoD ATS goals. ARGCS will be used to test, troubleshoot, and repair a variety of digital, radio frequency (RF), analog, electro-mechanical, and optical electronic LRUs and SRUs, both at home base and at deployed locations, and at maintenance levels from O-level to the factory. ARGCS will incorporate the parallel analog, serial bus test, synthetic instruments, multi-application software environment, and ATML programming language under the approved DoD ATS Architecture Framework. It may also include other technologies that are just now beginning development, such as a downsized electro-optics test system.

ARGCS will be capable of worldwide deployment in support of the highly diversified DoD missions with minimal airlift, support equipment, and logistics support. The concept is a core ARGCS with common control and support software with additive stimulus and measurement as necessary. A key performance parameter will be interoperability among weapon systems of not only the US Services but also those weapon systems used in coalition partner nations.

The ARGCS project addresses only the development/demonstration phase and each Service is responsible for their own integration and production of service implementations. The Navy, in its role as DoD ATS EAO, will lead the "acquisition" of the demonstration phase of the ARGCS project and will play whatever role the AMB jointly agrees upon during the Service implementation phase.

### *E. The Service Implementation Element*

As the ATS Technical Architecture Framework and the various test technologies mature, each Service will satisfy needs for new or modernized automatic testers by assembling a subset of the available technologies into an implementation that addresses its specific Service requirement. Each Service manages its own implementation of the Jointly developed test technologies. While each implementation will be a snapshot in time, the reliance on COTS will ease upgrading as the Spiral Development efforts continue over time. Given the unique nature of each Service's testing requirements, there are no plans for jointly acquiring a DoD ATS.

The following graphic, a Navy example (Fig.2), shows an example of how test technologies are incorporated into demonstration programs (ARGCS) as well as Service-specific production programs (RTCASS) and Service modernization programs (Modernized Mainframe CASS).

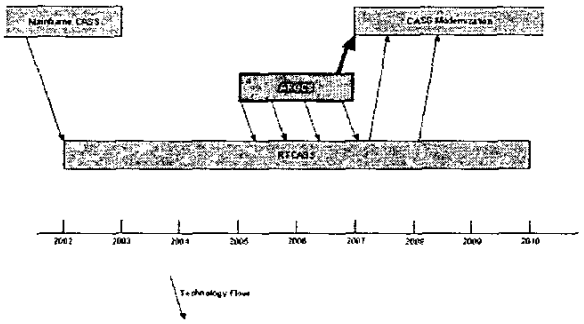


Figure 2. CASS family technology flow

## IV. Impact to Aviation Maintenance of Technology Implementations

### *A. Advantages and expected benefits of implementing the technologies in new or modified testers.*

The technologies and strategies discussed earlier offer significant operational benefits to the Services including:

- Facilitating the reuse of test software. Factory-to-field will become a reality as test software becomes readily transportable from factory level, to depot level to field level, including both intermediate and organizational levels.
- Expanded test capability in smaller packages. Testers in the field can now have full test capability in smaller, more transportable packages. The technologies will permit full test and diagnostics where previously smaller packages necessitated limitations to only test and check in some situations.
- Quicker to field new or expanded test capability. Implementing COTS components means rapid acquisition and fielding. Maintenance strategies will become much more flexible. Test capability formerly established at only factory or depot levels can be quickly established in the field at I or even O levels.
- Easier to upgrade. DoD testers themselves will be upgraded using a spiral development approach meaning that additional technologies will be incorporated as they are developed and as requirements become known
- Reduced distinction between levels of maintenance. Traditional lines demarking Organizational, Intermediate and Depot levels will blur. Maintenance boundaries will meld.
- Interoperability will become a reality. The new technologies will enable Joint operations that rely on

common, interoperable support systems. It will be feasible, for example, to test an F-16 UUT on a USMC tester in the forward battle area.

- Reduced support tail. Testers will require reduced air or sea lift capacity and will themselves need less support tail.
- Lower support costs. Since the testers themselves will be largely COTS, support costs will be lowered. When appropriate, Prime or OEM Performance Based Logistics contracts, such as the very effective CASS Consolidated Service Pool contract, can be readily implemented.

*B. The ultimate vision made possible by the new technologies:*

One potential innovation is an integrated Joint Service maintenance unit with a very robust, flexible test capability for virtually any avionics that requires test and diagnostics. The new organization would be a true "purple" unit; not just collocated but intermingled support capability from the Services, staffed and managed as an integrated Joint Maintenance Support Unit.

*B.1. An Organizational Starting Point*

Navy EA-6B Prowler Squadrons are land/carrier-based squadrons designed to provide electronic attack support to forward deployed joint/NATO forces. To make this mission successful, it was deemed necessary to establish dedicated, mobile, Intermediate level maintenance support and associated manpower in theatre with the combat squadron. This support is provided from forward-deployed activities known as Expeditionary Logistics Units (ELUs) currently located in Germany, Saudi Arabia and Turkey.

ELUs are primarily strategically collocated with or nearby existing USAF overseas operating bases. Each ELU possesses, operates and maintains its own facilities. Primary Support Equipment includes mobile vans, mobile electric power plants, frequency converters, peculiar support equipment, common support equipment, general purpose electronic test equipment, common automated test equipment (including CASS stations), supplies, and technical publications. In addition to the capabilities of the CASS, ALQ99 and radar test benches, the ELUs have many other capabilities including Miniature and Micro-Miniature Repair, COM/NAV Repair, Instrument Repair, Hydraulic Component Repair, Tire & Wheel build-up, and Hose and Tube Fabrication. Non-Destructive Inspection and X-ray services are obtained from the collocated USAF maintenance units.

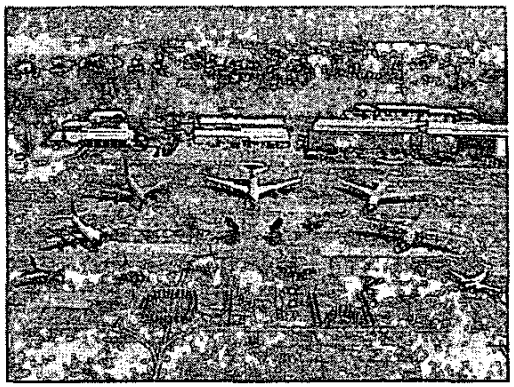

Figure 2. Operation Northern Watch Aircraft

With the similarities of the maintenance functions provided by the organizations that support a typical mix of coalition aircraft at a forward base (figure 1), there is great opportunity for mutual assistance. In fact, the ELUs are frequently called upon to assist other units, and they themselves receive assistance from collocated Air Force maintenance units. However, such assistance is mutually rendered on an ad hoc basis, at best.

Using the ELU example as a pathfinder, we can conclude that it is feasible for maintenance and support units from the Services to cooperate and even interoperate, given some similarity in support equipment. This is possible as has been demonstrated in areas such as NDI, ground servicing, and fueling. The lack of a common architectured, standard configuration automatic tester has prevented interoperability and cross-service support....until now.

*B.2. ARGCS – An ATS Starting Point*

ARGCS with its broad, flexible technical capability and interoperability features can be the centerpiece of a Joint Service avionics/electronics support organization. Its small size offers mobility, and its flexible software environment with its universal receiver interface will enable it to run virtually any test program from any tester.

Developed with interoperability as a key performance parameter, ARGCS will be the seed of a true "purple" maintenance organization.

The second major phase of the development of ARGCS will be a formal Joint Military Use Assessment (JMUA) to assess the operational capability of ARGCS in simulated operational scenarios. During the JMUA, ARGCS systems will be deployed in multiple U.S. service units located in battle groups

and deployed ground units, as well as at coalition partner sites. Among other things, the assessment will demonstrate interoperability among services and coalition partners, and scalability across O, I, and D maintenance levels. The JMUA will also assess the performance of ARGCS in a variety of deployment scenarios, including a "purple" maintenance organization. The results of the JMUA will provide the basis for implementation of a Joint Service avionics/electronics support organization.

## V. SUMMARY

The DoD Executive Agent for Automatic Test Systems has provided an architecture framework under which many exciting new test technologies are being developed and implemented across the Services. The Agile Rapid Global Combat Support System will provide the foundation for a new Joint Service avionics/electronics support organization where the lines between traditional levels of maintenance are blurred, and support becomes truly interoperable.

## REFERENCES

[1] Institute for Defense Analyses (IDA) Paper P-2917, "Investment Strategy for DoD Automatic Test Systems", Alexandria, VA, 1993.